



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN RE APPLICATION

Box:

AF

OF: BESSLING ET AL.

CONFIRMATION No.: 5757

SERIAL No. 09/341,921

GROUP ART UNIT: 1764

FILED: JULY 21, 1999

EXAMINER:

VIRGINIA MANOHARAN

FOR: PURIFICATION OF ETHYLENE OXIDE BY DISTILLATION

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner of Patents and Trademarks, Washington, D.C. 20231, on:

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Honorable Commissioner of
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Washington, D.C. 20231

BRIEF ON APPEAL UNDER 37 C.F.R. §1.192

Sir:

This is an Appeal from the Examiner's Final Rejection of Claims 1 to 9, dated October December 04, 2001. Claims 1 to 7 and 9 are currently pending.

REAL PARTY IN INTEREST:

The real party in interest is BASF Aktiengesellschaft, 67056 Ludwigshafen, Germany.

RELATED APPEALS AND INTERFERENCES:

To the best of the undersigned's knowledge, there are no related appeals or interferences within the meaning of 37 C.F.R. §1.192(c)(2).

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STATUS OF THE CLAIMS:

The claims on Appeal before the Board of Patent Appeals and Interferences are Claims 1 to 7 and 9. A copy of these claims is found in the attached Appendix.

STATUS OF THE AMENDMENTS:

Claim 1 has been amended, Claim 8 has been canceled and Claim 9 has been added under 37 C.F.R. §1.116 (Amendment dated March 11, 2002, Paper No. 08). In the Advisory action dated April 15, 2002, the Examiner indicated that appellants' respective amendment will be entered upon the filing of an appeal. No further amendments have been filed in this application after the final rejection.

SUMMARY OF THE INVENTION:

Appellants' invention relates to a process for separating a purified ethylene oxide from an aqueous mixture (ie. the "raw mixture") comprising ethylene oxide, formaldehyde and at least 5% by weight of water by way of a particular distillation setup. In accordance with appellants' process,

- the raw mixture is introduced into the distillation column between the top and the bottom of the column (ie. at the "feed point"),
- ethylene oxide which contains less than 4 ppm of formaldehyde is obtained as a fraction which is discharged at the top of the distillation column (ie. the "top fraction"), and
- an essentially aqueous fraction which contains less than 5% by weight of the ethylene oxide is obtained as the bottom fraction of the distillation column,

(ie. Claims 1 and 2).

The formaldehyde which is prone to contaminate ethylene oxide obtained from a distillation is formed in the production of the raw mixture and is present in the aqueous raw mixture predominantly in form of methylene glycol which is formed in an equilibrium reaction of formaldehyde and water. High(er) temperatures, as prevailing in the bottom part of a distillation column, shift the equilibrium to the side of monomeric formaldehyde. The monomeric formaldehyde which is formed at high(er) temperatures in the bottom part of the dis-

tillation column distills off from the bottom fraction along with the ethylene oxide (ie. page 5, indicated line 29, to page 6, indicated line 7, of the application).

In accordance with appellants' process, the respective purity of the ethylene oxide in the top fraction, coupled with the requisite ethylene oxide depletion of the bottom fraction of the distillation column is, broadly, achieved by utilizing the downward, ie. counter-current, flow of the raw mixture in the distillation column to absorb formaldehyde which emerges from the bottom part of the column.

In a first aspect of appellants' invention the requisite degree of reabsorption of the formaldehyde is obtained by locating the feed point at a height above the bottom of the column of at least 8 theoretical stages of the column, and additionally removing an acetaldehyde enriched fraction as a side stream from the column at a side take-off point which is located between the feed point and the bottom of the column (ie. Claims 1, 5 to 7 and 9).

In a second aspect of appellants' invention, the feed point at which the raw mixture is introduced into the column is adapted to the specific mass transfer area A of the column. In this aspect, the feed point is at a height above the bottom of the packed column which is at least " x^{min} ", determined in meters by the equation

$$x^{min} = 5.5 m - A \cdot 0.006 m^2,$$

wherein A represents the specific mass transfer area, in m^2/m^3 , of the distillation column (ie. Claims 2 to 4).

Unlike the processes which are known in the art for the purification of ethylene oxide, appellants' purification process is simple to perform and yields ethylene oxide which contains 4 ppm or less formaldehyde without the need for scrubbing steps involving high amounts of waste water (ie. page 3, indicated lines 1 to 10, of the application) as, for example, disclosed by *Gilman et al.* (US 3,418,338).

Furthermore, appellants' process is highly efficient in that less than 5% by weight of ethylene oxide remain in the bottom fraction of the distillation column. Since monomeric formaldehyde which is formed in the bottom part of the column is retained in the bottom part of the column due to the specific means of appellants' process, it is not necessary to avoid the formation of formaldehyde at the cost of considerable amounts of ethylene oxide which are retained in the bottom fraction as, for example, taught by *Delannoy et al.* (US-A 4,966,657 or its equivalent EP 322 323).

Additionally, since the formaldehyde is removed from the ethylene oxide stream in the body of the column to the requisite degree, the purified ethylene oxide having a formaldehyde content of 4 ppm or less can be recovered at the top of the column. In accordance with appellants' process it is therefore, for example, not necessary to "split" the upper fraction of the distillate into a formaldehyde contaminated fraction recovered at the top of the column and a purified ethylene oxide fraction recovered at a side take-off located below the top of the column as disclosed by **Coffey** (US 5,529,667).

ISSUES PRESENTED:

- I. Whether the Examiner erred finding that the subject matter of appellants' Claims 1 to 7 and 9 was *prima facie* obvious under 35 U.S.C. §103(a) in light of the disclosure of **Delannoy et al.** (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of **Gilman et al.** (US 3,418,338).
- II. Whether the Examiner erred finding that the subject matter of appellants' Claims 1 to 7 and 9 was *prima facie* obvious under 35 U.S.C. §103(a) in light of the disclosure of **Delannoy et al.** (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of **Coffey** (US 5,529,667).

GROUPING OF THE CLAIMS:

For the issues above, Claims 1, 5 to 7 and 9 have to be grouped separately from Claims 2 to 4.

A R G U M E N T S

I.a The Examiner erred finding that the subject matter of appellants' Claims 1, 5 to 7 and 9 was *prima facie* obvious under 35 U.S.C. §103(a) in light of the disclosure of **Delannoy et al.** (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of **Gilman et al.** (US 3,418,338).

The teaching of **Delannoy et al.** provides for a distillative purification of raw aqueous ethylene oxide mixtures wherein

- the raw mixture is introduced into the distillation column at a level located between approximately 1/2 and 3/4 of the theoreti-

cal number of plates of the column, counted from the top (ie. col. 3, indicated lines 41 to 45, of US 4,966,657);

- maintaining an amount of ethylene oxide in the bottom fraction which is between 0.3 and 1.5 times the amount of water¹⁾ in the bottom fraction (ie. col. 2, indicated line 63, to col. 3, indicated line 2, of US 4,966,657), and continuously removing the bottom fraction from the distillation column (ie. col. 4, indicated lines 1 to 7, of US 4,966,657);
- operating the distillation column at an absolute mean pressure of from 2.5 to 5 bar and a bottom temperature of from 40 to 60°C (ie. col. 3, indicated lines 35 to 41, of US 4,966,657); and
- discharging the purified ethylene oxide at the top of the column (ie. col. 3, indicated line 50 to 53, of US 4,966,657).

The purified ethylene oxide which is obtained in accordance with the process of **Delannoy et al.** has from 0.005 to 0.05% by weight of aldehyde-type impurities²⁾ (ie. col. 4, indicated lines 58 to 60, of US 4,966,657).

In principle, the process disclosed by **Delannoy et al.** achieves the purification of ethylene oxide by reducing the formation of monomeric formaldehyde at the bottom of the distillation column. The formation of monomeric formaldehyde is, on the one hand, reduced by continuously removing the bottom fraction. On the other hand, the formation of monomeric formaldehyde is reduced by maintaining the bottom fraction in the column at a temperature at which the equilibrium concentration of monomeric formaldehyde is sufficiently low. The measures which are applied in the process of **Delannoy et al.** to limit the formaldehyde contamination of purified ethylene oxide therefore necessitate that considerable amounts of ethylene glycol remain in the bottom fraction and are removed from the purification.

The teaching of **Delannoy et al.** does not suggest or imply means which provide a formaldehyde content of the purified ethylene oxide as specified in appellants' Claim 1 and, at the same time, a reduced ethylene glycol content of the bottom fraction of 5% by weight and

- 1) The respective ratio corresponds to an ethylene oxide content of the bottom fraction of from 15 to 75% by weight.
- 2) In accordance with the representative examples, col. 3, indicated line 13 et seq., of US 4,966,657, the purified ethylene oxide contains formaldehyde in amounts of at most 0.0005% by weight, corresponding to 5 ppm.

less³⁾ as required in accordance with appellants' process. The teaching of *Delannoy et al.* also fails to suggest or imply that an acetaldehyde enriched fraction is removed from the column at a side take-off which is located between the feed point and the bottom of the column as required in accordance with appellants' process.

In accordance with the teaching of *Gilman et al.* purified ethylene oxide having a formaldehyde content of below 50 ppm is obtained in an extractive distillation, illustrated in Figures 2 to 4⁴⁾, wherein

- the raw mixture is introduced into the column between the bottom part and the top part,
- extracting water is introduced into the upper part of the column as illustrated in Figure 2 of *Gilman et al* by line 112b, and
- steam is introduced into the lower part of the column as illustrated in Figure 2 of *Gilman et al.* by line 115.

As illustrated in the representative examples disclosed by *Gilman et al.*, the column is operated at an overhead temperature of 103°C (ie. Examples 1 to 3, col. 4 et seq., of US 3,418,338) and 72°C (ie. Example 4, col. 5, of US 3,418,338).

The principle which is applied in the process disclosed by *Gilman et al.* to remove formaldehyde from ethylene oxide vapors makes use of the fact that the equilibrium concentration of monomeric formaldehyde at a given temperature is reduced when the amount of water is increased. Accordingly, the extracting water which is introduced into the upper part of the column in accordance with the process of *Gilman et al.* serves to remove monomeric formaldehyde from the vapor phase of the column and to "bind" it in form of methylene glycol.

Similar to the teaching of *Delannoy et al.*, the disclosure of *Gilman et al.* fails to suggest or imply the removal of an acetaldehyde enriched fraction from the column at a side take-off which is located between the feed point and the bottom of the column as required in accordance with appellants' process.

3) In light of the principles applied in the purification in accordance with the teaching of *Delannoy et al.* an attempt to reduce the ethylene oxide content of the bottom fraction requires increased bottom temperatures. Increased temperatures at the bottom of the distillation column, however, result in an increased formation of monomeric formaldehyde and, consequently, in an increased contamination of the product obtained at the top of the column. An increase of the temperature prevailing at the bottom of the distillation column would, therefore, destroy the purpose of the purification process taught by *Delannoy et al.*

4) For example, col. 2, indicated lines 38 to 49, of US 3,418,338.

The Examiner contends that the purity of the ethylene oxide which is recovered as the top fraction of the distillation which is required in accordance with appellants' Claims 1, 5 to 7 and 9, as well as the degree of ethylene oxide depletion of the bottom fraction specified in those claims, are no more than "desired results", and that a person of ordinary skill could arrive at those results by mere routine optimization of the process disclosed by **Delannoy et al.** The Examiner's position is deemed to be in error because the principles which are applied in the process disclosed by **Delannoy et al.** provide that a decrease of the amount of ethylene oxide in the bottom fraction results in an increase in the aldehyde content of the ethylene oxide fraction which is recovered over to top of the distillation column. It is, therefore, not scientifically sound to assert that a mere optimization of the process disclosed by **Delannoy et al.** results in a decreased amount of ethylene oxide in the bottom fraction and, at the same time, a decreased aldehyde contamination of the ethylene oxide fraction which is recovered over to top of the distillation column.

The Examiner further takes the position that a person of ordinary skill would have used the teaching of **Gilman et al.** (US 3,418,338) as a motivation to optimize the process of **Delannoy et al.** because **Gilman et al.** disclose the requisite amounts of ethylene oxide in the bottom fraction and of formaldehyde in the top fraction which are specified in appellants' claims. However, the motivation to improve on the requisite amounts in the process of **Delannoy et al.** alone does not suggest or imply the means which are necessary to arrive at the desired result. It is impermissible within the framework of Section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts which are necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art (ie. In re Wesslau, 353 F.2d 238, 241, 147 USPQ 391, 393 (CCPA 1965)).

In accordance with the teachings of **Delannoy et al.** and of **Gilman et al.** the formaldehyde content of the purified ethylene oxide which is obtained in the top fraction of the distillation can be reduced

- (1) by limiting the amount of monomeric formaldehyde which enters the vapor phase by way of a reduced bottom temperature in accordance with the process of **Delannoy et al.**,
- (2) by limiting the amount of monomeric formaldehyde which enters the

vapor phase by way of removing the bottom phase continuously in accordance with the process of *Delannoy et al.* and *Gilman et al.*⁵⁾, and

- (3) by extracting monomeric formaldehyde from the vapor phase by a countercurrent flow of considerable amounts of water which are introduced to the top part of the column in accordance with the process disclosed by *Gilman et al.*

Since it is necessary to increase the temperature of the distillation in order to arrive at the reduction of the ethylene oxide content of bottom fraction to the requisite degree, the principle (1) on which the purification disclosed by *Delannoy et al.* relies cannot be used in a combination of the processes which is to result in the features of appellants' invention as claimed. If the principle (1) is omitted, however, the process of *Delannoy et al.* is replaced by the process of *Gilman et al.*

In order to arrive at the ethylene oxide content in the bottom fraction which is achieved in the process of *Gilman et al.*, more than a mere modification of the teaching of *Delannoy et al.* is required. Essentially, one would need to turn away from the principles of the process disclosed by *Delannoy et al.*, and would need to apply conditions which prohibit that those principles remain applicable. Under such circumstances the Court has held that the teachings of the references are not sufficient to render a claimed invention *prima facie* obvious (ie. *In re Ratti*, 270 F.2d 810, 813, 123 USPQ 349, 352 (CCPA 1959)).

Even if the teachings of *Delannoy et al.* and of *Gilman et al.* are combined, or the first is taken in view of the second as applied by the Examiner, the referenced prior art fails to teach or suggest all of the limitations of appellants' process which are defined in Claim 1, since neither *Delannoy et al.* nor *Gilman et al.* teach or suggest the removal of an acetaldehyde enriched fraction from the column at a side take-off which is located between the feed point and the bottom of the column as required in accordance with appellants' process.

To establish a *prima facie* case of obviousness, three basic criteria must be met (MPEP §2143). First, there must be some suggestion or

5) The process of *Gilman et al.* also applies this principle in that the bottom fraction and, additionally, a purge containing excess formaldehyde is continuously withdrawn from the bottom fraction of the distillation as illustrated in Examples 1 and 2 (ie. col. 4, indicated lines 14 to 21), Example 3 (ie. col. 4, indicated lines 50 to 57), and Example 4 (ie. col. 5, indicated lines 8 to 11) of *US 3,418,338*.

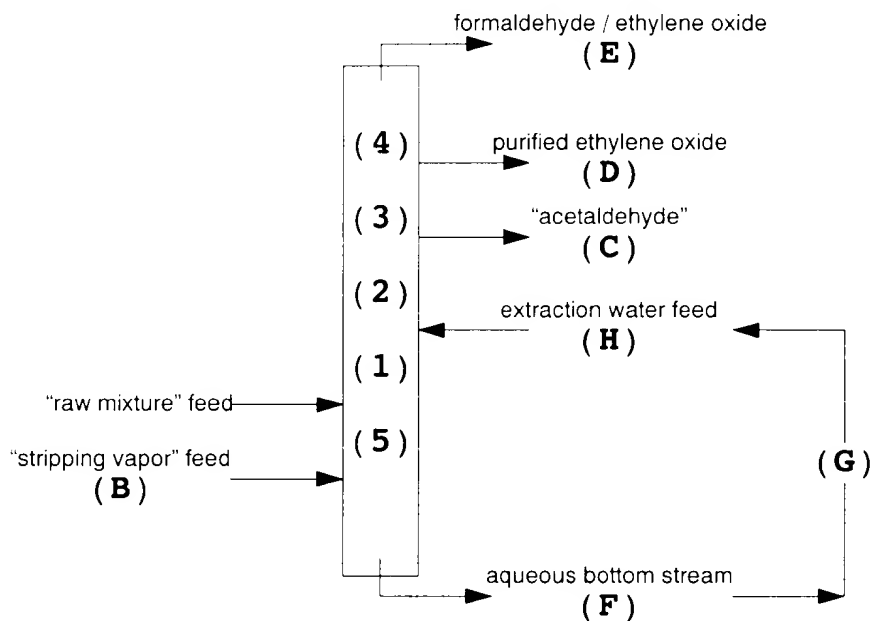
motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings in the manner which is necessary to arrive at the claimed invention. Second, there must be a reasonable expectation of success, and, finally, the prior art reference (or the references when combined) must teach or suggest all the claim limitations. Where the combined teachings of *Delannoy et al.* and of *Gilman et al.* are concerned, at least the third of the three criteria for establishing a prima facie case of obviousness is clearly not met.

The Examiner's further argues that the language of appellants' claims, "A process ... comprising", is open and allows that additional measures, ie. either the measures taken in the process of *Delannoy et al.* or the measures taken in the process of *Gilman et al.*, are taken in appellants' process to improve on the purity of the ethylene oxide product or the ethylene oxide depletion of the bottom fraction. The respective position is not deemed to be appropriate in a determination under 35 U.S.C. §103(a). Section 103(a) of the Patent Act provides that a claimed invention is unpatentable when the claimed subject matter considered "as a whole" would have been obvious to a person of ordinary skill in the pertinent art "at the time the invention was made". Accordingly, in determining obviousness the decision-maker has to return to the time at which the invention was made (note, for example, *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (CAFC 1988), cert. denied, 488 U.S. 825 (1988); *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 16 USPQ2d 1923 (CAFC 1990)) and cannot rely on information or knowledge gleaned from the applicant's invention. The question in the determination under Section 103(a) is whether the prior art provides a teaching or suggestion of the particular combination of features which defines the claimed invention. It is not relevant in this context whether the claimed invention can be practiced in a manner which, in addition to the particular combination of features defined in the claims, makes use of known principles.

The Examiner's position that appellants' invention as defined in Claim 1 and further specified in Claims 5 to 7 and 9 is rendered obvious within the meaning of Section 103(a) by the disclosure of *Delannoy et al.* when taken in view of the teaching of *Gilman et al.* is, therefore, in error.

II.a The Examiner erred finding that the subject matter of appellants' Claims 1, 5 to 7 and 9 was *prima facie* obvious under 35 U.S.C. §103(a) in light of the disclosure of *Delannoy et al.* (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of *Coffey* (US 5,529,667).

The teaching of *Coffey* aims at further reducing the amount of aldehydic impurities and at reducing the water consumption of conventional extractive distillations⁶⁾. Accordingly, the respective disadvantages of conventional extractive distillations are obviated when the extractive distillation is essentially setup as follows⁷⁾:



In the purification of raw ethylene oxide mixtures which is taught by *Coffey*,

- the raw mixture is introduced into the distillation column between a first fractionation region (1) and a fifth fractionation region (5), which corresponds in accordance with the Example (ie. col. 10, indicated line 43, to col. 11, indicated line 10, of US 5,529,667) and Figure 3 to a feed point at a height of 10 stages above the bottom (ie. col. 10, indicated lines 50 to 52, of US 5,529,667);

- 6) One of the conventional extractive distillations referenced by *Coffey* is the teaching of *Gilamn et al.* which is summarized in col. 2, indicated lines 12 to 18, of US 5,529,667.
- 7) The illustration is based on the summary of the invention, col. 3, indicated line 14, to col. 4, indicated line 28, of US 5,529,667. Bold letters and numbers in parenthesis correspond to the letters and numbers used by *Coffey* to distinguish between features.

- the bottom fraction (F), which is in accordance with the Example at a temperature of about 120°C to 150°C, is essentially free of ethylene oxide and is continuously removed (ie. col. 4, indicated lines 9 to 12, of US 5,529,667);
- the purified ethylene oxide (D) is withdrawn from the column as a side stream below the fourth fractionation region (4) (ie. col. 3, indicated lines 61 to 65, of US 5,529,667), which corresponds in the Example and Figure 3 to an ethylene oxide fraction having a formaldehyde content of about 2 to 10 ppm which is removed as a side stream at about 7 stages below the top (ie. col. 11, indicated lines 4 to 10, of US 5,529,667);
- the ethylene oxide obtained at the top of the column is contaminated by formaldehyde (E) (ie. col. 3, indicated line 66, to col. 4, indicated line 8, of US 5,529,667), which corresponds in the Example and Figure 3 to a formaldehyde content of about 100 ppm (ie. col. 11, indicated lines 7 to 9, of US 5,529,667); and
- an acetaldehyde enriched fraction (C) is removed as a side stream above the feed point (ie. col. 3, indicated lines 57 to 60, of US 5,529,667), which corresponds in the Example and Figure 3 to a side take-off at stage 48 of the column (ie. col. 11, indicated lines 1 to 4, of US 5,529,667).

Essentially, the purification of ethylene oxide in the process of **Coffey** applies in the removal of formaldehyde the following principles:

- (a) limiting the amount of monomeric formaldehyde which enters the vapor phase by way of removing the bottom phase continuously⁸⁾;
- (b) extracting monomeric formaldehyde from the vapor phase by a countercurrent flow of reduced amounts of water, including a part of the bottom product, which are introduced into the lower part of the column⁹⁾; and
- (c) distinguishing between formaldehyde contaminated ethylene oxide which is recovered as a top fraction of the distillation, and purified ethylene oxide which is recovered as a side stream below the top of the column.

8) The same means are used by the process of **Delannoy et al.** and of **Gilman et al.**, see No. (2) on page 7 et seq. of this paper.

9) The extraction used by **Coffey** is a variant of the extraction method applied in the process of **Gilman et al.** which reduces the amount of extracting water, compare No. (3) on page 8 of this paper.

In order for the process of **Coffey** to be feasible, it is necessary that the bottom product is essentially free of ethylene oxide. For the process of **Delannoy et al.**, however, it is required that considerable amounts of ethylene oxide remain in the bottom product. An attempt to combine the process of **Delannoy et al.** and the process of **Coffey**, or to modify the process of **Delannoy et al.** in light of the teaching of **Coffey**, in such a manner that the bottom product contains less than 5% by weight of ethylene oxide, inevitably replaces the process of **Delannoy et al.** by the process of **Coffey**. Appellants' remarks on the suitability of a combination of the teachings of **Delannoy et al.** and **Gilman et al.** apply mutatis mutandis where the disclosure of **Delannoy et al.** is combined with, or considered in view of, the teaching of **Coffey**.

Even if the disclosures of **Delannoy et al.** and of **Coffey** are combined, or the first is taken in view of the second as applied by the Examiner, the referenced prior art fails to establish that appellants' process defined in Claim 1 is prima facie obvious within the meaning of 35 U.S.C. §103(a):

- There is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine referenced teachings in such a manner as necessary to arrive at appellants' invention. An attempt to implement the conditions which are necessary to arrive at the ethylene oxide depletion of the bottom product in the process of **Delannoy et al.** requires that one turns away from one of the principles¹⁰⁾ which is used to reduce the formaldehyde contamination¹¹⁾.
- As addressed in the foregoing and in footnote 11), there is no reasonable expectation of success.
- The prior art referenced by the Examiner fails to teach or suggest all the claim limitations¹²⁾. The mere fact that the prior

10) Ie. limiting the amount of monomeric formaldehyde in the vapor phase by way of reducing the temperature prevailing in the bottom region of the distillation column; see No. (1) on page 7 of this paper.

11) It is equally not feasible to apply the teaching of **Delannoy et al.** to collect the purified ethylene oxide as a top fraction to the process of **Coffey** since **Coffey** teaches that the top fraction is contaminated by about 100 ppm of formaldehyde.

12) The **Coffey** reference fails to teach or suggest (i) to withdraw a purified ethylene oxide which has a formaldehyde content of 4 ppm or less at the top of the distillation column, and (ii) to withdraw an acetaldehyde enriched fraction between the feed point and the bottom of the distillation column.

art can be modified in some manner which yields the invention as claimed does not support a conclusion of obviousness¹³).

Where the teachings of *Delannoy et al.* and *Coffey* are concerned, none of the three basic criteria to establish a prima facie case of obviousness is met. The Examiner's position that appellants' invention as defined in Claim 1 and further specified in Claims 5 to 7 and 9 is rendered obvious within the meaning of Section 103(a) by the disclosure of *Delannoy et al.* when taken in view of the teaching of *Coffey* is, therefore, in error.

I.b The Examiner erred finding that the subject matter of appellants' Claims 2 to 4 was prima facie obvious under 35 U.S.C. §103(a) in light of the disclosure of *Delannoy et al.* (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of *Gilman et al.* (US 3,418,338).

In the aspect of appellants' invention which is defined in Claim 2 and further specified in Claims 3 and 4, the feed point at which the raw mixture is introduced into the column is adapted to the specific mass transfer area "A" of the column. In this aspect, the feed point is located at a height above the bottom of the packed column which is at least " x^{min} ", determined in meters by the equation

$$x^{min} = 5.5 m - A \cdot 0.006 m^2,$$

wherein "A" represents the specific mass transfer area, in m^2/m^3 , of the distillation column.

Neither the teaching of *Delannoy et al.* nor the teaching of *Gilman et al.* suggest or imply that the location of the feed point is essential with regard to the resulting degree of purification of the ethylene oxide which is recovered at the top of the column, or the degree of ethylene oxide depletion of the bottom fraction. Except for the illustrations in Figures 2 to 4, the disclosure of *Gilman et al.* is completely silent about the location of the feed point¹⁴), and the disclosure of *Delannoy et al.* merely provides that the raw mixture is introduced into the distillation column at a level located between approximately 1/2 and 3/4 of the theoretical number of plates of the column, counted from the top (ie. col. 3, indicated lines 41 to 45, of US

13) ie. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (CAFC 1984); see also, eg., Interconnect. Planning Corp. v. Feil, 774 F.2d 1132, 227 USPQ 543 (CAFC 1985)

14) In accordance with Figures 2, 3 and 4 of *Gilman et al.* the feed point is located in the upper half section of the distillation column.

4,966,657), ie. in the lower half of the column. Based on the teachings of *Delannoy et al.* and *Gilman et al.*, taken in combination with one another or the first taken in view of the second as applied by the Examiner, a person of ordinary skill would therefore not have considered the location of the feed point as a result effective variable.

The same applies *mutatis mutandis* where a correlation of the mass transfer area "A" to the location of the feed point, is concerned. Neither the teaching of *Delannoy et al.* nor the disclosure of *Gilman et al.* provide any information in that regard. To assert that either the height of the feed point or its correlation to the mass transfer area are result-effective variables as done by the Examiner raises the question which result or results of the process are effectively influenced by varying the respective parameters. It is also not apparent what kind of an influence a variation of the respective parameters is likely to have on the result or results. Where the prior art has not recognized the result-effective capability of a particular invention parameter, there is clearly no expectation that an optimization of the parameter will successfully yield the desired result (ie. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977)).

In light of the foregoing, neither one of the references applied by the Examiner, nor a combination thereof, provides the requisite teaching or suggestion to make the particular modification which is needed to arrive at the subject matter defined in appellants' claims, or the reasonable expectation that a modification of the particular process parameter(s) is likely to be successful to obtain a purified ethylene oxide in the top fraction of the distillation and, at the same time, the requisite degree of ethylene oxide depletion of the bottom fraction. However, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and cannot be based on the disclosure of the claimed invention in a proper determination of obviousness under Section 103(a) (ie. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (CAFC 1991)).

The combined teachings of *Delannoy et al.* and of *Gilman et al.* therefore fail to meet the three criteria for establishing a prima facie case of obviousness where the subject matter of appellants' Claims 2 to 4 is concerned. The Examiner's position that appellants' invention as defined in those claims is rendered obvious within the

meaning of 35 U.S.C. §103(a) by the disclosure of *Delannoy et al.* when taken in view of the teaching of *Gilman et al.* is, therefore, deemed to be in error.

II.b The Examiner erred finding that the subject matter of appellants' Claims 2 to 4 was prima facie obvious under 35 U.S.C. §103(a) in light of the disclosure of *Delannoy et al.* (US-A 4,966,657 or its equivalent EP 322 323) when taken in view of the teaching of *Coffey* (US 5,529,667).

As stated in the remarks on Issue (I.b), the disclosure of *Delannoy et al.* contains nothing which suggests or implies that the degree of purification which is achieved in the process, or the degree of ethylene oxide depletion of the bottom fraction of the distillation, is influenced by the location of the feed point. The same applies to the disclosure of *Coffey*. Moreover, neither one of the referenced teachings, alone or in combination with one another, suggests or implies that an adjustment of the feed point in correlation to the mass transfer area of the column allows for a distillation which provides purified ethylene oxide having a formaldehyde content of 4 ppm or less as the fraction recovered at the top, and which -at the same time- provides a bottom fraction which contains less than 5% by weight of ethylene oxide.

With regard to the subject matter of appellants' Claims 2 to 4, a combination of the teaching of *Delannoy et al.* and the disclosure of *Coffey* provides no more than the combination of the teaching of *Delannoy et al.* and the disclosure of *Gilman et al.* Appellants' respective remarks on Issue (I.b) therefore equally apply to the Examiner's rejection based on *Delannoy et al.* when taken in view of *Coffey*.

The Examiner's position that appellants' invention as defined in Claim 2 and further specified in Claims 3 and 4 is rendered obvious within the meaning of Section 103(a) by the disclosure of *Delannoy et al.* when taken in view of the teaching of *Coffey* is, therefore, in deemed to be error.

C O N C L U S I O N

For the reasons stated above, appellants respectfully urge that the Examiner erred in finding that the subject matter of Claims 1 to

7 and 9 was rendered *prima facie* obvious by the disclosure of *Delannoy et al.* when taken in view of the teaching of *Gilman et al.* or *Coffey*. It is therefore respectfully requested that the Examiner's decision be reversed.

REQUEST FOR EXTENSION OF TIME:

It is respectfully requested that a four month extension of time be granted in this case. A check for the \$1,440.00 fee is attached.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees to Deposit Account No. 11.0345. Please credit any excess fees to such deposit account.

Respectfully submitted,

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Encl.: THE CLAIMS ON APPEAL

HBK/BAS

A P P E N D I X:

THE CLAIMS ON APPEAL:

1. (*twice amended*) A process for purification of ethylene oxide by distillation, comprising the step in which
 - an aqueous mixture comprising ethylene oxide, formaldehyde and at least 5% by weight of water is introduced via a feed into a distillation apparatus comprising at least one distillation column, the mixture being introduced at a height above the bottom of at least 8 theoretical stages,
 - pure ethylene oxide containing 4 ppm or less formaldehyde, is taken off at the top and
 - in the bottom phase, a mixture is obtained which contains less than 5% by weight of ethylene oxide,and wherein the distillation apparatus has a side take-off between the feed and the bottom, and a mixture which is richer with acetaldehyde than the influent aqueous mixture is taken off via said side take-off.
2. (*amended*) A process for purification of ethylene oxide by distillation, comprising the step in which
 - an aqueous mixture comprising ethylene oxide, formaldehyde and at least 5% by weight of water is introduced via a feed into a distillation apparatus comprising at least one packed column which contains a structured or bulk packing and has a specific mass transfer area A , the mixture being introduced at a height above the bottom of at least x^{\min} , in m , which, for a given specific mass transfer area A , in m^2/m^3 , is given by the equation
$$x^{\min} = 5.5 m - A \cdot 0.006 m^2,$$
 - pure ethylene oxide containing 4 ppm or less formaldehyde, is taken off at the top and
 - in the bottom phase a mixture is obtained which contains less than 5% by weight of ethylene oxide.
3. A process as claimed in claim 2, wherein the aqueous mixture is introduced via the feed at a height of from $1.5x^{\min}$ to $7x^{\min}$.
4. A process as claimed in claim 2, wherein the specific mass transfer area A is in the range from $100 m^2/m^3$ to $500 m^2/m^3$.

5. A process as claimed in claim 1, wherein the aqueous mixture comprising ethylene oxide, formaldehyde and at least 5% by weight of water is introduced via a feed into a distillation apparatus comprising at least one plate column, the mixture being introduced at a height above the bottom of at least 12 plates.
6. (*amended*) A process as claimed in claim 1, which further comprises the step in which further mixture, comprising water, is additionally introduced via a feed line at a height of at least one theoretical stage or plate above the feed of the aqueous mixture.
7. A process as claimed in claim 1, wherein flame-arresting packings are used in the distillation apparatus.
9. (*twice amended*) A process as claimed in claim 1, wherein the distillation apparatus is used in which an intermediate reboiler is situated between the feed and the bottom.